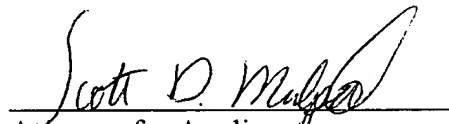Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our address given below.

Respectfully submitted,

Attorney for Applicants
Scott D. Malpede
Registration No. 32,533

FITZPATRICK, CELLA, HARPER & SCINTO
30 Rockefeller Plaza
New York, New York 10112-3801
Facsimile: (212) 218-2200

SDM:eyw

## MARKED-UP VERSION SHOWING CHANGES TO THE CLAIMS

1.      (Amended) A method of processing data defining first polygons which approximate at least part of a curved three-dimensional surface to produce second polygons for use in rendering an image of the surface, the method including for each first polygon the [steps] processing operations of:

defining a respective surface patch to approximate the part of the object surface represented by the first polygon;

dividing the first polygon into a plurality of notional polygons; [and]

calculating a respective normal vector for each vertex of each notional polygon; and

for each notional polygon, defining a said second polygon for rendering using the surface patch of the first polygon and the calculated normal vectors for the vertices of the notional polygon to determine the positions of the vertices of the second polygon in three dimensions.

4.      (Amended) A method according to claim 1, wherein the [step] operation of defining a surface patch for a first polygon comprises calculating control values at control points for the first polygon to define the surface patch.

10.    (Amended) A method according to claim 1, wherein, in the [step] operation of dividing a first polygon into notional polygons, the division is performed in dependence upon an average area of at least some of the first polygons in a current frame of image data or a previous frame of image data [at least one of the size of the first polygon in a previous frame of image data, the size of the first polygon in the current frame of image data, the curvature of the first polygon, the distance of the first polygon from the viewing position in a previous frame of image data, and the distance of the first polygon from the viewing position in the current frame of image data].

15.    (Amended) A method according to claim 1, wherein, in the [step] operation of defining a second polygon for a notional polygon, vertices for the second polygon are calculated in dependence upon the distance of the surface patch above each vertex of the notional polygon and in dependence upon the calculated normal vectors for the vertices of the notional polygon.

16.    (Amended) A method according to claim 15, wherein, in the [step] operation of defining a second polygon for a notional polygon, vertices for the second polygon are calculated by:

[(i) calculating the distance of the surface patch above each vertex of the notional polygon;

(ii) calculating a normal at each vertex of the notional polygon; and

(iii)] for each vertex of the notional polygon, setting the position of a vertex for the second polygon at the point which lies a distance from the vertex of the notional polygon equal to the distance [calculated in step (i)] of the surface patch above the vertex of the notional polygon in the direction of the normal [calculated in step (ii)] vector calculated for the vertex of the notional polygon.

17.    (Amended) A method according to claim [16] 15, wherein a forward differencing technique is used to calculate the distance of the surface patch above each vertex of each notional polygon.

18.    (Amended) A method according to claim 1, further comprising the [step] processing operation of filling gaps between the second polygons generated for rendering.

22.    (Amended) A method according to claim 1, wherein the [step] operation of defining a surface patch is performed by processing data in object space, and the [step] operation of defining second polygons is performed in viewing space.

23.    (Amended) A method according to claim 1, further comprising the

[step] processing operation of calculating lighting values for each second polygon by evaluating a

polygon lighting equation for at least one of ambient, diffuse and specular light.


25.    (Amended) A method according to claim 23, wherein, in the [step]

operation of calculating lighting values, the number of notional polygons into which each surface

patch is divided is determined, and:

(i) if the number of notional polygons is less than a predetermined number, a

lighting value is calculated for each vertex of the second polygons by evaluating the lighting

equation for each vertex; and

(ii) if the number of notional polygons is greater than a predetermined number,

a respective second surface patch is calculated for each first polygon, and a lighting value is

calculated for each vertex of the second polygons using the second surface patches.


26.    (Amended) A method according to claim 24, wherein the [step]

operation of calculating a second surface patch for a first polygon includes [the steps of]:

(i) evaluating the lighting equation to calculate a lighting value at a plurality of

control points for the first polygon; and

(ii) calculating values defining the second surface patch such that the surface

patch interpolates the lighting values calculated at the control points.

27.     (Amended) A method according to claim 24, wherein, in the [step]

operation of using a second surface patch to calculate a lighting value for a vertex of a second

polygon, the lighting value is calculated using the height of the second surface patch above the

first polygon at the vertex of a notional polygon which corresponds to the vertex for which the

lighting value is to be calculated.

29.     (Amended) A method according to claim 1, further comprising the

[step] operation of generating a signal conveying the second polygons.

30.     (Amended) A method according to claim 1, further comprising the

[step] operation of producing rendered image data.

31.     (Amended) A method according to claim 30, further comprising the

[step] operation of generating a signal conveying the rendered image data.

32.    (Amended) A method according to claim 31, further comprising the

[step] <u>operation</u> of recording the signal.


33.    (Amended) A method according to claim 30, further comprising the

[step] <u>operation</u> of displaying an image using the rendered image data.


34.    (Amended) A method according to claim 30, further comprising the

[step] <u>operation</u> of making a recording of the image data either directly or indirectly.


35.    (Amended) A method of generating polygons approximating at least a

part of the surface of a three-dimensional object for use in rendering an image of the object, in

which:

an initial polygonal model of the surface <u>comprising a mesh of triangular</u>

<u>polygons</u> is processed to generate a mesh of <u>cubic Bernstein-Bezier triangular</u> surface patches

approximating the surface; and

a further polygonal model of the surface is generated using the surface patches

<u>by dividing each triangular polygon in the initial polygon model into a plurality of notional</u>

<u>triangular polygons and, for each notional triangular polygon, defining a triangular polygon for</u>

<u>the further polygonal model using the cubic Bernstein-Bezier triangular patch of the</u>

corresponding triangular polygon in the initial polygonal model to calculate the positions in three-dimensional space of the vertices of the triangular polygon for the further polygonal model.

36.    (Amended) Apparatus for processing data defining first polygons which approximate at least part of a curved three-dimensional surface to produce second polygons for use in rendering an image of the surface, comprising:

a patch definer for defining a respective surface patch for each first polygon to approximate the part of the object surface represented by the first polygon;

a polygon divider for dividing each first polygon into a plurality of notional polygons; [and]

a normal vector calculator for calculating a respective normal vector for each vertex of each notional polygon; and

a polygon definer for defining, for each notional polygon, a said second polygon for rendering using the surface patch of the corresponding first polygon and the calculated normal vectors for the vertices of the notional polygon to determine the positions of the vertices of the second polygon in three dimensions.

45.    (Amended) Apparatus according to claim 36, wherein the polygon divider is arranged to perform the division in dependence upon an average area of at least some

<u>of the first polygons in a current frame of image data or a previous frame of image data</u> [at least

one of the size of the first polygon in a previous frame of image data, the size of the first polygon

in the current frame of image data, the curvature of the first polygon, the distance of the first

polygon from the viewing position in a previous frame of image data, and the distance of the first

polygon from the viewing position in the current frame of image data].

      50.    (Amended) Apparatus according to claim 36, wherein the polygon

definer is arranged to calculate vertices for each second polygon in dependence upon the distance

of the surface patch above each vertex of the notional polygon <u>and in dependence upon the</u>

<u>calculated normal vectors for the vertices of the notional polygon.</u>

      51.    (Amended) Apparatus according to claim 50, wherein the polygon

definer [comprises] <u>is operable to calculate the vertices for each second polygon by</u>:

      [(i) a distance calculator for calculating the distance of the surface patch above

each vertex of the notional polygon;

      (ii) a normal calculator for calculating a normal at each vertex of the notional

polygon; and

      (iii) a vertex setter for setting,] for each vertex of the <u>corresponding</u> notional

polygon, <u>setting</u> the position of a vertex for the second polygon at the point which lies a distance

from the vertex of the notional polygon equal to the distance [calculated by the distance

calculator] <u>of the surface patch above the vertex of the notional polygon</u> in the direction of the

normal [calculated by the normal calculator] <u>vector calculated for the vertex of the notional</u>

<u>polygon</u>.

52.     (Amended) Apparatus according to claim [51] <u>50</u>, wherein the distance

calculator is arranged to calculate the distance using a forward differencing technique.

66.     (Amended) Apparatus for generating polygons approximating at least a

part of the surface of a three-dimensional object for use in rendering an image of the object,

comprising:

a mesh generator for processing an initial polygonal model of the surface

<u>comprising a mesh of triangular polygons</u> to generate a mesh of <u>cubic Bernstein-Bezier triangular</u>

surface patches approximating the surface; and

a polygon model generator for generating a further polygonal model of the

surface using the surface patches <u>by dividing each triangular polygon in the initial polygon model</u>

<u>into a plurality of notional triangular polygons and, for each notional triangular polygon, defining</u>

<u>a triangular polygon for the further polygonal model using the cubic Bernstein-Bezier triangular</u>

<u>patch of the corresponding triangular polygon in the initial polygonal model to calculate the</u>

positions in three-dimensional space of the vertices of the triangular polygon for the further

polygonal model.


Claims 69-106 are non-elected.


107.    (Amended) A computer graphics processing method, comprising:

receiving data defining [a representation of] a three-dimensional computer

model of at least a part of a curved three-dimensional object surface, the three-dimensional

computer model comprising a plurality of representations, each of a respective portion of the

object surface; [and]

calculating an average area of at least some of the representations;

determining the number of polygons to be generated to replace each respective

representation in dependence upon the calculated average area; and

[dividing the] for each representation, [into a plurality] generating the

determined number of polygons for rendering to replace the representation, wherein the number

of polygons [is determined in dependence upon the area of the representation] generated for each

representation is the same.

108.    (Amended) A method according to claim 107, wherein the [number of polygons is determined in dependence upon the] average area [of] is calculated using the at least some of the representations in a previous frame of image data.

109.    (Amended) A method according to claim 108, wherein the [number of polygons is determined in dependence upon the] average area [of] is calculated using the at least some of the representations in the frame of image data immediately preceding the frame for which the polygons are being generated for rendering.

110.    (Amended) A method according to claim 108, wherein the average area [of the representation] is determined using the coordinates of vertices of polygons rendered in the previous frame of image data.

111.    (Amended) A method according to claim 107, wherein the [number of polygons is determined in dependence upon the] average area [of] is calculated using the at least some of the representations in the frame of image data for which the polygons are being generated for rendering.

112.    (Amended) A method according to claim 111, wherein the <u>average</u> area [of the representation] is determined by transforming points defining the representation<u>s</u> into the two-dimensional image coordinate system.

113.    (Amended) A method according to claim 111, wherein the <u>average</u> area [of the representation] is determined by transforming a volume bounding a plurality of representations into the two-dimensional image coordinate system.

114.    Cancelled

115.    (Amended) A method according to claim 107, wherein the [determined] <u>average</u> area is used as the input to a look-up table to generate a value indicating the number of polygons <u>to be generated to replace each respective representation</u> for rendering.

116.    (Amended) A method according to claim 107, wherein the number of polygons <u>to be generated to replace each representation</u> is determined in dependence upon the <u>average</u> area [of the representation] and also the curvature of [the] <u>at least one</u> representation.

117. (Amended) A method according to claim 107, wherein [the] each representation is a polygon.

118. (Amended) A method according to claim 107, wherein [the] each representation is a parametric surface patch.

119. (Amended) A method according to claim 118, wherein [the] each representation is a Bezier patch, and the average area is determined using the control points defining the corners thereof.

120. (Amended) A method according to claim 107, further comprising the [step] operation of rendering the polygons to produce rendered image data.

121. (Amended) A method according to claim 120, further comprising the [step] operation of generating a signal conveying the rendered image data.

122. (Amended) A method according to claim 121, further comprising the [step] operation of recording the signal.

123.    (Amended) A method according to claim 120, further comprising the

[step] <u>operation</u> of displaying an image using the rendered image data.

124.    (Amended) A method according to claim 120, further comprising the

[step] <u>operation</u> of making a recording of the image data either directly or indirectly.

Claims 125-126 are non-elected.

127.    (Amended) Computer graphics processing apparatus, comprising:

a receiver for receiving data defining a [representation of] <u>three-dimensional</u>

<u>computer model of at least</u> a part of a curved three-dimensional object surface<u>, the three-</u>

<u>dimensional computer model comprising a plurality of representations, each of a respective</u>

<u>portion of the object surface</u>;

<u>an average area calculator for calculating an average area of at least some of</u>

<u>the representations;</u>

a polygon <u>number</u> calculator for determining <u>a number defining</u> the number of

polygons [into which the representation is to be divided] <u>to be generated</u> for rendering <u>to replace</u>

<u>each respective representation</u> in dependence upon the <u>calculated average</u> area [of the

representation]; and

a [divider] <u>polygon generator</u> for [dividing] <u>generating</u> the [representation into the calculated] <u>determined</u> number of polygons <u>to replace each representation</u> for rendering<u>, so that each representation is replaced with the same number of polygons</u>.

128.    (Amended) Apparatus according to claim 127, wherein the [polygon] <u>average area</u> calculator is arranged to [determine the number of polygons in dependence upon] <u>calculate</u> the <u>average</u> area <u>using at least some</u> of the representation<u>s</u> in a previous frame of image data.

129.    (Amended) Apparatus according to claim 128, wherein the [polygon] <u>average area</u> calculator is arranged to [determine] <u>calculate</u> the [number of polygons in dependence upon the] <u>average</u> area <u>using at least some</u> of the representation<u>s</u> in the frame of image data immediately preceding the frame for which the polygons are to be generated for rendering.

130.    (Amended) Apparatus according to claim 128, wherein the [polygon] <u>average area</u> calculator is arranged to [determine] <u>calculate</u> the <u>average</u> area [of the representation] using the coordinates of vertices of polygons rendered in the previous frame of image data.

131. (Amended) Apparatus according to claim 127, wherein the [polygon] average area calculator is arranged to [determine] calculate the [number of polygons in dependence upon the] average area using at least some of the representations in the frame of image data for which the polygons are to be generated for rendering.

132. (Amended) Apparatus according to claim 131, wherein the [polygon] average area calculator is arranged to [determine] calculate the average area [of the representation] by transforming points defining the representations into the two-dimensional image coordinate system.

133. (Amended) Apparatus according to claim 131, wherein the [polygon] average area calculator is arranged to [determine] calculate the average area [of the representation] by transforming a volume bounding a plurality of representations into the two-dimensional image coordinate system.

134. Cancelled

135. (Amended) Apparatus according to claim 127, wherein the polygon number calculator is arranged to use the [determined] average area as the input to a look-up table

to generate a value indicating the number of polygons <u>to be generated to replace each respective</u> <u>representation</u> for rendering.

136.    (Amended) Apparatus according to claim 127, wherein the polygon <u>number</u> calculator is arranged to determine the number of polygons <u>to be generated to replace</u> <u>each representation</u> in dependence upon the <u>average</u> area [of the representation] and also the curvature of [the] <u>at least one</u> representation.

137.    (Amended) Apparatus according to claim 127, wherein [the] <u>each</u> representation is a polygon.

138.    (Amended) Apparatus according to claim 127, wherein [the] <u>each</u> representation is a parametric surface patch.

139.    (Amended) Apparatus according to claim 138, wherein [the] <u>each</u> representation is a Bezier patch, and the [polygon] <u>average area</u> calculator is arranged to determine the <u>average</u> area using the control points defining the corners thereof.

Claims 142-143 are non-elected.

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Claims 146-169 are non-elected.

170.    (Amended) Apparatus for rendering a three-dimensional computer graphics model, comprising:

a receiver for receiving data defining a computer model of a three-dimensional object made up of a plurality of representations each of which models a respective part of the object;[and]

a polygon generator for replacing each respective representation with the same number of polygons for rendering, and for storing data defining the polygons for subsequent use; and

a renderer for rendering [each representation,] the [renderer being operable such that the same number of] polygons; [are used to render each representation, and data defining the polygons for different depths is stored and used in preference to calculating the polygons]

wherein, in use, the apparatus is controlled such that:

when the three-dimensional computer model is to be rendered for a second or subsequent time, stored polygon data is rendered if the stored data defines the required number of polygons for each representation, otherwise the polygon generator is controlled to replace each

representation with the required number of polygons for rendering and to store data defining the polygons for subsequent use.

Claims 171-172 are non-elected.

173.    (Amended) Apparatus for processing data defining first polygons which approximate at least part of a curved three-dimensional surface to produce second polygons for use in rendering an image of the surface, comprising:

patch defining means for defining a respective surface patch for each first polygon to approximate the part of the object surface represented by the first polygon;

dividing means for dividing each first polygon into a plurality of notional polygons;[and]

normal vector calculating means for calculating a respective normal vector for each vertex of each notional polygon; and

polygon defining means for defining, for each notional polygon, a said second polygon for rendering using the surface patch of the corresponding first polygon and the calculated normal vectors for the vertices of the notional polygon to determine the positions of the vertices of the second polygon in three dimensions.

174.    (Amended) Apparatus for generating polygons approximating at least a part of the surface of a three-dimensional object for use in rendering an image of the object, comprising:

means for processing an initial polygonal model of the surface comprising a mesh of triangular polygons to generate a mesh of cubic Bernstein-Bezier triangular surface patches approximating the surface; and

means for generating a further polygonal model of the surface using the surface patches by dividing each triangular polygon in the initial polygon model into a plurality of notional triangular polygons and, for each notional triangular polygon, defining a triangular polygon for the further polygonal model using the cubic Bernstein-Bezier triangular patch of the corresponding triangular polygon in the initial polygonal model to calculate the positions in three-dimensional space of the vertices of the triangular polygon for the further polygonal model.

Claims 175-176 are non-elected.

177.    (Amended) Computer graphics processing apparatus, comprising:

means for receiving data defining a [representation of] three-dimensional computer model of at least a part of a curved three-dimensional object surface, the three-

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dimensional computer model comprising a plurality of representations, each of a respective

portion of the object surface;

means for calculating an average area of at least some of the representations;

means for determining a number defining the number of polygons [into which

the representation is to be divided] to be generated for rendering to replace each representation in

dependence upon the calculated average area [of the representation]; and

means for [dividing] generating the [representation into the calculated]

determined number of polygons to replace each representation for rendering, so that each

respective representation is replaced with the same number of polygons.


Claims 178-180 are non-elected.